SCIENCE

New Series
Vol. LX, No. 1552

Friday, September 26, 1924

Annual Subscription, $6.00
Single Copies, 15 Cts.

SCIENCE

Vol. LX SEPTEMBER 26, 1924 No. 1552

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

PROSPECTS AND RETROSPECTS[1]

It is a time-honored custom that, once a year, the president of the American Chemical Society should deliver a "presidential address." As the years roll by, the list of these addresses has become quite formidable and various subjects have been touched upon by my distinguished predecessors. But through many of them runs an ever recurring trend of thought relating to the problems and scope of chemistry in America, from the standpoint of each period at which the different addresses were delivered.

In masterly presentation, in broadness of view, or in confidence in the future of our science, I doubt if any of these addresses have surpassed the first of them all, delivered in 1876 ("Science in America," *J. A. C. S.*, Vol. 1, 1877) by our earliest president, John W. Draper.

In some of these addresses, difficulties were pointed out or doubts were expressed as well as optimistic wishes. To-day, after I have reread every one of them, I find comfort in the fact that the most cherished hopes of earlier years have already become a solid reality.

We may well devote a few minutes to this subject before we touch upon other matters. Our growth has been enormous, nevertheless it was gradual. Even in 1890, after fourteen years of existence, we counted only 256 members. At that time we printed a modest journal, hardly known then outside of the United States. To-day, our membership, approaching 15,000, exceeds by far that of any other chemical society in the world.

The scope and variety of our publications have increased in the same way. Besides our older journal, which now mainly prints subjects concerning purely theoretical research, we have our *Journal of Chemical Abstracts* which since 1906 has made us the only country independent of the heretofore indispensable German *Chemisches Centralblatt.* Then in 1909 we launched our *Industrial and Engineering Chemistry,* particularly devoted to applied chemistry or scientific research related thereto and which lately has been reinforced by its semi-monthly supplement, the "News edition." Nor should we fail to mention the *Chemical Monographs,* published in book form, and the more recent *Chemical Review;* truly a handsome list of publications covering every department of chemistry—and which have acquired such interna-

[1] An address delivered by the president to the members of the American Chemical Society at the September, 1924, meeting, held at Cornell University, Ithaca, New York.

tional importance that no chemical library can be considered complete without them.

I feel no hesitation whatever in making this short survey of our flourishing condition, because I know very well that in this matter I can not assume any personal credit, beyond that which belongs in common to every one of the thousands of devoted members of the past and the present, who have helped to bring our society where it stands to-day.

But I want to put special stress upon the fact that this healthy growth of the American Chemical Society came from within, from the spirit of its own members. We had to rely on our own efforts without any outside help or gifts or subsidies.

If it were not for that inner spirit of cooperation and high purpose, our society could not continue to exist in its present robust condition. With its sixty-nine local sections spread out over the vast territory of our Republic; with its fourteen divisions covering as many special fields in chemistry; with each section, each division, autonomous in action within certain limits, each having its own chairman, we practise a method of decentralization leaving abundant scope for initiative, yet requiring a community of purpose subordinate to a general plan of action. This plan of action is formulated by the council of the society where every section, however small, has its representatives who express and decide the general policy and aims of the society.

The magnitude of the present responsibilities incumbent upon the business management of the society seems rather obvious by the fact that our yearly expenditures amount to about $370,000; more than a thousand dollars every living day. Most of this money is spent on our publications, relatively little on salaries. The details of the expenditures are set forth in our yearly published balance sheet.

The greatest single work of the society has been the dissemination of chemical literature. Our publications are not undertaken for monetary gain so that our main source of revenue still consists in membership dues. Our income and expense accounts balance rather closely at the end of the year and we are compelled to use the interest money of our surplus funds for this purpose. This in itself is quite an achievement which has only been possible by paring expenses and by most devoted business management.

I do not present these statements so that we may rest on our laurels and indulge in self-satisfaction, but so that they might spur us on to further efforts and to new opportunities of service.

Our present resources are becoming too scant to keep pace with the rapidly increasing chemical literature which has to be reported in our *Chemical Abstracts*. The same can be said of our other journals where valuable papers from our members have sometimes to be refused for publication on account of lack of space. Yet the most important purpose of our journals is to publish chemical information. It is quite significant that the greatest increase in our membership dates from the time when we extended this service by the publication of our newer journals. During the latter months plans for securing additional funds have been devised which are now ready to be put into operation.

The American Chemical Society through its members has much helped to develop or to create various industries in this country where chemistry plays an important rôle. It has also contributed in no small measure to extend and to perfect our methods of teaching chemistry in our universities and engineering schools, thus furnishing to the nation an increasing number of men better fitted for the research work and the chemical engineering fundamental to our industries as well as to the development of our science.

The period when Americans were compelled to go abroad to study chemistry has long since passed. It was quite natural that the United States should have had to evolve through the same phase through which Germany had to pass when in 1822 Liebig had to travel to Paris and study chemistry there under Gay-Lussac, Dulong and Thenard. Later on, the disciple became himself a master in his own country. But the great development of chemical science and chemical research which followed in Germany would hardly have been possible but for the new favorable conditions brought about by the early manufacture of synthetic dyes in that country after the original discovery of Perkin in England. The very nature of that new industry put an unprecedented premium on research in organic chemistry. Fame, honors and monetary rewards were the alluring inducements offered to the best available chemical talent in Germany. No wonder then that startling discoveries occurred in rapid succession. The organic chemist had suddenly become more important than the engineer who heretofore had been guiding the destinies of the older well-established soda and acid works. Whether we like to admit it or not, much of the history of science has been shaped by the needs and the outside influences of commerce or industry.

But the importance and the money value of the German dye industry were not the only factors which brought about this result. Some of the men at the head of these chemical industries in Germany were chemists of no mean ability, who by their very training were able to realize how most of their business problems were immediately dependent upon the latest discoveries in science, and who could think as chemists as well as business men, an art not easily acquired.

Nor is it astonishing that not only in Germany but

also in other countries some of the most successful chemical enterprises were mainly owned and directed by men well trained as chemists or as chemical engineers.

Such men succeeded in building up their chemical enterprises with a broader perspective, a greater attempt at permanency and a congenial feeling toward their work. In other words, their business was not merely a means for immediate gain; nor were they ever ready to toss over their holdings in their company to the highest bidder as soon as a better field for money-making presented itself.

I believe that in the future the most permanent chemical enterprises in the United States will be those in which chemists and engineers of ability play a considerable part in the general business policies.

This does not mean that chemical enterprises directed exclusively by men who are chemists but who lack sound judgment or business common sense are likely to be successful. Examples to the contrary make up the endless story of wrecks and unsuccessful ventures in the chemical industries of every country. Some of the most exalted names in chemical science have been connected with such defunct enterprises.

Scientific thought often compels intense concentration on one single subject, one single factor of a many-sided problem. To some scientists that single factor may appear of paramount importance while other equally important factors entering into a practical problem are apt to be underestimated.

Any such one-sided points of view may cause little harm to their author in the publication of a book or of a purely scientific paper, even though sometimes they result in stubborn scientific polemics. Stubbornness in purely scientific points of view is not always easily cured, and sometimes clings like a dogma; but the man of affairs or the industrial chemist who refuses to be taught by his mistakes risks ending in the poor-house.

These considerations, simple as they may be, have not unfrequently been overlooked by men of great erudition and superior intelligence who in their career as teachers or writers or research workers were able to live by themselves in a world confined by their lecture room, their library and their laboratory.

If such men are given opportunities to cut their teeth on some practical problems they may grow to be of decidedly greater service to their science or its applications.

It has been my privilege to live and work amongst every kind of chemist and I have known of very few instances where a chemist exclusively engaged in purely theoretical work did not broaden his conceptions and increase his abilities after he had been given an opportunity to deal with a practical problem. Some of the most distinguished of them only attained their full value as teachers or research men after they had become consultants on problems of applied chemistry which taught them to grapple with hard, real facts instead of basking in the sun of self-satisfying hypothesis.

Far be it from me to urge the teacher of chemistry or the investigator of purely scientific problems to sell his birthright for a mess of pottage. Any one who looks in chemistry for nothing but a means of getting rich has chosen the wrong career. The same efforts would lead him sooner to that goal by following more direct money-making pursuits which do not require such a long and difficult preparation.

All these considerations point to another phase of the great mission of the American Chemical Society, by its drawing together of all chemists in whatever different line of work they may be engaged. Undoubtedly, the present age requires specialists, but the most limited being as man or citizen is the over-specialist.

The gospel of research has now been so well preached in the United States for so many years that to-day no other country spends so much money and effort along these lines in industrial as well as in educational and special research institutions. On the other hand, I wonder whether our efforts towards good teaching, good lecturing on chemical subjects, have not relaxed somewhat. Teachers who captivate their classes and arouse enthusiasm for their subject have never been very common among chemists and, I should add, physicists.

Dull and uninteresting presentation of some of the most inspiring conquests of science occur too frequently. Even in very elementary lectures on chemistry or physics unnecessary recourse is frequently made to exclusively mathematical methods which makes it easier for the teacher, but the lack of visualization, the very spirit of the subject, is often lost upon his hearers. Pasteur, Tyndall, Huxley and Darwin used the simplest possible language when explaining science to the general public. They were not afraid of making science accessible to everybody. If more scientists had followed their example, science might have had a more humanizing effect on the present generation. Many people who glorify themselves in a purely literary or artistic education might have been kept in closer touch with the trend of our modern world. They would have been able to realize that it is idle to dream and think and act in the spirit of past centuries, that it is dangerous to cling exclusively to teachings of the history of long disappeared ages while in our problems of to-day and to-morrow we are confronted with new conditions,

new possibilities so radically different from the life of the past and all created by the developments of scientific investigation and invention. Whether we like to or not, we must adapt ourselves to these newer conditions which also shape our newer duties. If not, we place ourselves in the same dangerous attitude of those Bourbons of whom it is said that "they could not forget anything old and could not be taught anything new."

Science, and chemistry in particular, has been repeatedly reproached for all the horrors of the late war, for all the present unrest, dissatisfaction and—what not? By whom? By the very people who have least tried to grasp the immense strides of our knowledge and the undreamt-of new powers it brings along; by men who have failed to perceive in time the vastly increased responsibilities the new powers involved.

The militarists and politicians who started the European war were steeped in Bourbonism. They knew all the tricks of former wars. If they knew anything, it was the political history of the past. At best they were thinking in terms of the eighteenth century instead of the twentieth. It did not appear obvious to them that the wars of Napoleon were much nearer the conquest of Gaul by the Romans than 1870 was to 1914. Unfortunately, just that class of people ruled the destinies of nations.

If they had been able to contemplate the awesome responsibilities of the present age they might have hesitated starting that conflagration. Chemists certainly did not start nor encourage that war. They were called in only after the conflagration seemed to get beyond control. Some clergymen and some moralists now reproach us for our science—they say that we have not grown up fast enough with our moral responsibilities. Some of them have gone as far as to suggest that we should stop teaching science and research in our schools and that we should find our mental food exclusively in the classic lore of the past. It does not occur to them that theologists and preachers in Germany were amongst the most rabid jingoists. That great educator and philosopher, Dr. Charles W. Eliot ("A Late Harvest," The Atlantic Monthly Press, Boston), writes: "For the last six hundred years the Christian nations have fought oftener and harder than the so-called heathen. Within the past two centuries all the great wars have been fought on Christian soil by Christian soldiers."

After all, the men who belittle science do not appear very different in their attitude from the so-called noble Indians who, proud and blissful in the traditions of their successful tribal wars and their skillful use of bows and arrows, were suddenly confronted with cannon, rifles and gun powder which had come into existence without their knowledge.

We must not overlook that potent factor that our present generation, even in the most civilized countries, is extremely heterogeneous, although all wear the same clothes and externally seem rather alike. The great majority amongst us have been dragged into a civilization into which they do not belong; for which they are not prepared. Under the surface run the thoughts and aspirations of past centuries, an attitude utterly irreconcilable with the new conditions which have arisen in the meantime. This state of mind is bad enough with the average person who meekly realizes his lack of knowledge. It may become supremely dangerous with the man or woman of power who has had a classical college education and who remains unaware that we live in an entirely new world and who stubbornly continues to think and argue in terms of the past.

Our new means of communication and transportation, and the latest engines of destruction, chemical and mechanical, have upset all former conditions of war. At the same time our cities, our industries, our agriculture and our whole modern civilization are all based and organized upon the endless applications of science and are decidedly dependent upon peace. Similar to a delicate watch, one single broken cog will stop it all. Men have quite a different impression about war, according to whether they are in the front line trenches or whether they read about it casually in the newspapers or if they are nicely sheltered in distant cities or live with the staff at general headquarters.

For the first time in history London and Paris had a slight demonstration how bombing airplanes can mock city walls, fortifications, or warships. But these were only some of the merest beginnings amongst the many new tricks which have become available since then.

Any one who is acquainted with later developments of the means of scientific destruction knows very well that the limit has not yet been reached, and that in future wars nobody will find a snug place where he may think he is safe or can escape the consequences. The largest and best protected cities, irrespective of their size or distance, will be continuously exposed to destruction and mutilation. Death and torture of the inhabitants will occur whether they are slumbering in their beds at night or whether they are reading their newspapers in their comfortable clubs or saying their prayers at church. There will be no way of safeguarding women or children or the old or the infirm.

But the remedy to these horrors lies not in stopping the use of chemistry in warfare. Chemistry has been used in war since early ages. Whether it was under the shape of the stinkpots or gunpowder of the Chinese against sword or bow and arrows, or whether it was the twentieth century chemical methods, in every instance the soldiers who were subjected to it at first indignantly protested, until pretty soon they used the same or even more drastic means in return.

The greater remedy seems to be more of a plain generous week-day religion of deeds, rather than a Sunday religion of words; less hypocrisy, haughtiness, lying and suspicion, and more decency and good will amongst peoples, in place of smug pedantic theology.

But do not blame the chemists for what will happen if irresponsible, tactless politicians or writers continue needlessly to arouse the worst feelings in other nations. Pin pricks hurt as much as stabs. But after the harm is committed the chemist as well as the soldier and the sailor has no choice left but to do his part and to help straighten the mess into which they have been drawn by the silliness or boorishness of others.

In the meantime these reproaches recklessly hurled at us should not make us lose faith in the noble purposes of our real mission. At the recent meeting of the British Association for the Advancement of Science, one of Britain's most distinguished physicians stated that every town in the world owes a statue in gratitude to Pasteur, the great French chemist. The rôle of chemistry is essentially constructive; to make this world more comfortable, happier and better to live in, to elevate the human race. Never has our field along these lines been more promising than today. I am not one of those who tends to exaggerate the benefits of chemistry in the creation of thousands of new synthetic dyes except for the enormous fund of new chemical knowledge we have gathered thereby and which has helped immensely in other more valuable directions.

In the meantime our fickle and over-dyed world now seems to have been supplied abundantly enough. Incomparably more promising fields beckon us to better endeavors. Amongst those fields none is more inspiring than that of the biochemist. Biochemistry, one of the younger branches of our science, has been confronted by many handicaps and its progress has been necessarily slow. It is still harassed by great experimental obstacles, but the newer revelations, technique and methods of other departments of science are now being used there to excellent advantage. Lately the study of the chemistry of endocrine glands seems to open the most startling possibilities.

If our predecessors in science scarcely ventured to foresee the realities of the present in what were then called visions or idle dreams, what dreams of the future may we indulge in if the mere chemical functions of some gland may make a man good or bad, strong or feeble, intelligent or stupid, peevish or happy, courageous or cowardly, generous or greedy?

Shall the biochemist become gradually a factor in the elimination of our houses of correction, our poor houses, lunatic asylums, as well as in the organization of our educational institutions? Who knows?

L. H. BAEKELAND

THE NEEDS OF PUBLICATION IN TROPICAL MEDICINE[1]

A CRITICAL survey of all the publications in the world devoted to tropical medicine would be an attractive and desirable achievement, but it is more of a project than I can undertake at present, and instead a few observations are submitted on the records of the English-speaking countries. These records are, of course, only a small part of the expression of creative racial energies in our civilization as a whole. They are of great significance, however, because many social as well as individual failures in the tropics have been due to the neglect or lack of scientific medicine, while many successes can be credited to its cultivation.

Practically all our special records in tropical medicine have been born in the last thirty years. In other words, we are in the midst of a movement and can not fully appreciate just what is going on. The message of science, however, is that man's life on this globe is more or less in his own hands, and it is indicated to see, if possible, in what direction we are traveling.

In view of the proved economic value of scientific medicine in the tropics, it might be thought that adequate avenues of expression would be provided. It might be thought that the recording of the precious workings of consciousness would be a first consideration. Such, however, is not the case. While a good deal has been done along these lines, too often immediate results and financial and administrative factors are given precedence. Scientific records are apt to be the last to be established and the first to feel the cut of economy. For example, it has been reported that some of the medical records of the Panama Canal Zone have been discontinued as not necessary for the operation of the canal. Again, when a study has been made, an author often has difficulty in placing his work. If finally placed, it may be delayed many months in publication and the author may have to share the expense. Many publications are operating on a slender margin, and editors have a difficult time between pressure for reduction of expense, on the one hand, and on the other the demands of the subject for adequate and dignified expression.

What is to be said about this situation? If scientific medicine is really so valuable in tropical civilization, its fruits should be guarded and treasured.

Of course scientific publication, like everything else, must in a measure make its own way in the struggling world. There is a healthful and saving

[1] Read at the International Conference on Health Problems in Tropical America, at Kingston, Jamaica, under auspices of the Medical Department of the United Fruit Company, July 23–31, 1924.

element in the struggle for existence, but it should not be necessary to fight over the same ground indefinitely. Now that the scientific approach has proved its value and possibilities, it should be made easier rather than obstructed.

In surveying the situation, we come sooner or later to the responsibility of the individual worker. Before asking the world to accept our currency, we should see to it that it has a par value. There is a constant need for the self-criticism and self-discipline which Pasteur so often insisted on. Scientific work has now a certain place, but many workers abuse the privileges of their position. They string their stories out to an unconscionable length. They take side trips up blind alleys and substitute egotism and personal idiosyncrasy for the serious and noble ideals of conscious effort. In recording scientific work, it is impossible to make a cinematograph of every move in the laboratory or at the bedside or in the operating room. The world can justly demand that the worker furnish only the really valuable and significant products and that the wastebasket be duly patronized.

Granting that some struggle for existence is desirable and that the individual worker plays the game fairly, what can reasonably be expected in this field of human endeavor? A brief survey of existing means of publication will bring out some of the possibilities.

Records of tropical medicine can be classified as follows:

(1) Articles in general journals or publications. Some of Ross's first work was reported in the *Lancet* and in the *British Medical Journal* and Reed's first report was in the Proceedings of the American Public Health Association. Of course, any general journal is willing and eager to publish important papers from any field of medicine, but the significance of some work is not always apparent at first and much solid work has no general appeal. The editor of a general journal can not be expected to give much space to exotic subjects. There are, of course, some general journals published in the tropics or subtropics which help the situation. The drawback to these journals is that they are apt to be local in circulation and therefore to have a somewhat limited if not a precarious existence.

(2) Special journals, which may be subdivided into (a) Popular journals, (b) research journals.

The best all-round journal is the *Journal of Tropical Medicine and Hygiene,* founded in August, 1898, as a monthly and now published as a bi-weekly. It had its struggles at first, but now seems well established. It contains editorials, personal notes and some reviews, as well as regular articles. This journal has for years been a welcome arrival to many physicians in the tropics. A counterpart in American literature would be desirable.

Most of the journals, such as *Annals of Tropical Medicine,* the *Indian Journal of Medical Research,* the *Philippine Journal of Science* and the *American Journal of Tropical Medicine,* can be called research journals in the sense that they present chiefly studies of subjects rather than clinical experiences and contain little or no personal matter, editorials or reviews. The subject of reviews will be taken up later, but it is believed there is a place even in these journals for personal notes and for occasional editorials.

Efficiency and progress depend on specialization, and specialists require some medium of expression. This is best secured through special publications. The stimulating effect of special journals is well known. But, of course, there is a limit to the support of such publications, and one of the great troubles of the present is that there are so many special journals struggling to exist in various fields of medicine that they overlap and compete with each other and eventually some of them have to drop out. Some 1,900 journals are received each year at the Army Medical Library. This is a larger number than would be allowed as necessary by a super-censor of scientific matters. The field of tropical medicine is large enough to support certain media of expression but not large enough for much competition. Cooperation rather than competition is needed with specialization within the field. By a gentleman's agreement or otherwise, certain kinds of work should appear in certain kinds of publications.

(3) Reports of organizations, like the Isthmian Canal Commission and the United Fruit Company, which contain much valuable material mixed in with other matter of less general interest. If these publications are to have the best standing as professional publications, the scientific material should not be buried with administrative and statistical matters but should be dignified as in the latest report of the United Fruit Company by a separate section, and in many instances summaries should be published in standard journals. Attempts to curtail these publications, like the recent one on the Canal Zone, should be resisted with all our influence. Once started, these reports become indexes of progress and afford an important means of yearly comparison which should by all means be perpetuated.

(4) Government reports. Some government reports, such as those of India and the British Colonial Office, are standard scientific publications and are issued in suitable form. More often, however, scientific data are effectively concealed in a husk of routine matter. Another way of burying data is to put it in a confidential report. Other reports are so

inconclusive that they are appropriately buried in the files. Anything of significance should be brought out into the daylight of current information, either in an established series of scientific reports or in recognized scientific journals.

(5) Bulletins of institutions and schools, like those of the Wellcome Research Laboratories and the Liverpool School of Tropical Medicine.

These can be classed as standard publications, and members of the staffs of these institutions are fortunate in such facilities. But many series of bulletins have come to an untimely end and remain dumbly on library shelves like the blind ends of extinct lines in charts of organic evolution. Scientific medicine has a survival value in our civilization which should be reflected in our records.

(6) Proceedings of the societies, congresses and conferences. These serve a most useful purpose. The proceedings of the Royal Society of Tropical Medicine are a model of interest and technique of publication. The records of congresses and conferences are mines of information if sufficiently distributed and not too long delayed. The plans for the record of this unique conference show the fullest realization of the title of this paper.

(7) Abstracts. The material scattered about in the various publications which have just been roughly outlined evidently needs to be brought to a common focus. This is wonderfully accomplished by the *Bulletin* of the Tropical Diseases Bureau. It is difficult to praise this publication too highly. Practically every written record is reviewed, and in addition the reviewers often give a critical opinion of the work. This seems to me a much needed feature in abstracts, but one seldom attempted. Of course it can be abused, but a fair criticism by a competent reviewer would help keep our records straight. The editors are to be congratulated on this work. Another most valuable feature is the summaries which are given in each subject at intervals by experienced workers. Altogether this abstract journal is all that could be hoped for and makes the ordinary fragmentary review section seem inadequate. This bulletin can not be competed with nor dispensed with. The Referate of the German *Centralblatt* attempts something of the same kind, but it is questionable if they can reach again the position they held before the war.

(8) Although this survey is concerned with the publications in English, reference should be made to the bi-weekly Spanish edition of the *Journal of the American Medical Association* which has been issued since 1920. The *American Journal of Tropical Medicine* since its foundation in 1921 has also published summaries of each article in Spanish. It is difficult to say just how valuable these measures are, but they stand for an attempt to recognize the important place that Spanish civilization holds in Pan-America.

(9) Some mention should be made of books. This field is well covered for general use by Manson's classical work and Stitt's condensed manual. For reference, we have Castellani and Chalmer's encyclopedic work and Archibald and Byam's "System." The cost of the latter work, however, about $40.00, suggests some of the difficulties which editors and publishers face in covering this field. Valuable as books are in their place, they can not replace other publications any more than a letter can replace a telegram. Even journals can not keep up with the rapid developments, and parts of books are obsolete before publication, and new editions are regularly needed.

It will be noted that a number of these publications have the support of institutions and this is very necessary in these days of increased cost of illustration, tabulation and publication in journals. Several of these journals, however, are simply struggling individual journals. If you will allow a personal remark, it is a matter of record that the secretary-treasurer of the American Society of Tropical Medicine and the editor of the journal each receive $25.00 a year for their labors. It is encouraging to note that philanthropic support of medicine is beginning to include publications as well as buildings.

After all, the individual is the conscious unit and while mass effort and equipment are justly emphasized, the battles of science are fought and won or lost by the struggling personality. The individual worker should be encouraged by prompt and adequate publication. On the other hand, the editor must see that the urge of the ego does not interfere with the social aim to be achieved by the work.

In short, my argument is for increasing recognition of and organization in publication in tropical medicine. Along with expenses for buildings, laboratories, physicians and workers, the budget should provide for means of record and transmission. Folklore methods have no place in science. When a new institution or school is founded, means of publication should be carefully considered. If the budget is sufficient for a permanent series of bulletins, these should be provided for. Otherwise, existing agencies should be used.

In the swirl of modern life an emphasis on ideals and standards is more than ever needed. Medicine has too great a mission to allow itself to drift in the matter of records. There should be regular ways of record from the first flicker of an idea in the brain of the worker, through the society or journal to the abstract journal and the world at large.

The author of "The Grand Strategy of Evolution," in a striking passage on humanity as an organism, the new social Leviathan, says:

The universe is its habitat, the earth its den, and the

earth like an egg, is a well-provisioned residence. In the narrow cleft, between the more substantial earth and the blanket of its enveloping atmosphere, it lives and moves and multiplies; riding free the currents of terrestrial circulation; creeping into inviting valleys; crossing nature's bridges as they emerge; and following up the favoring shores of ancient causeways; spreading out where life is easier in denser racial spots and larger sprawling patches; linked over no-man's land by thread-like filaments of interlacing traffic; or intermingling hostile bloods, and merging spots and patches into one, the living film at last grows around the world, shutting in its cosmic heritage. East then meets west, and north meets south on common territory.

As this process goes on and man becomes more conscious of his destiny and more able to control it, how necessary it is that consciousness applied to physical and mental ills of the vast tropical zone shall have sufficient means of record. How urgent is the need for the encouragement of the individual worker in the hot countries by adequate publication of worthy efforts! Such are the motives which should animate our editors in their particular labors.

Henry J. Nichols

Army Medical School,
Washington, D. C.

MUSICAL ECHOES

The description of "Analyzed sounds in nature," by Professor Alexander Forbes (Science, July 4, 1924), calls attention to a very interesting and very beautiful phenomenon. It has remained until now practically unknown. The description in the poem of Emerson, which Professor Forbes quotes, is both of fine literary quality and also scientifically precise; but the reader would scarcely infer from it that the fact referred to is a definite thing in nature, distinct from the ordinary echo, and well worthy of search by every lover of nature who wanders among the hills.

My interest in this matter was first aroused during a visit to Sicily in 1900. There, at Syracuse, is a quarry in which, as we know from the history of the Greek wars, were confined 7,000 "beautiful Athenians" captured from the invading army sent at the instigation of the demagogue Alcibiades. From death there only those escaped who, as slaves to the Syracusans, could recite passages from the then fashionable plays of Euripides. In the wall of this quarry is hollowed out a cave of a peculiar trumpet shape, large below, but narrowing and curving upward to a small opening at the upper level. Here (by tradition) was wont to come the tyrant Dionysius, who a few years later established the empire of Syracuse over all Sicily and southern Italy, and himself as its master. Listening at this small opening he could hear distinctly not only the groans but every whispered secret of his political enemies imprisoned in the quarry and cavern below. The cavern is called the "ear of Dionysius." The lower chamber of this enormous trumpet is entered from the floor of the quarry and is (or was 25 years ago) closed by a wooden door. Slamming this door or even clapping his hands, the guide demonstrated the extraordinary reverberations which for some time afterward rolled about the cavern. These reverberations were of quite different quality from the original sound causing them; they were musical tones with suppression of all mere noises. He also asked that some member of the party of sightseers sing a scale or a bar of a few notes; and thereupon occurred, not an echo in the sense of a reproduction of the original sounds of the voice; instead it was as if on a mighty organ in a cathedral many stops had been opened in various combinations and sequences.

Two years later, during a summer vacation at Mt. Desert on the Maine coast, the climbs among its hills afforded me opportunities for observing the phenomena of analyzed sounds, or musical, or spectral echoes in nature. Indeed, the search for positions in which they could be elicited added interest and pleasure to the walks and climbs equal even to that of the scenery. It is well known to all who visit the romantic mountains, lakes and fjords of Mt. Desert that there are at several points quite perfect mirror echoes. Every sound, harsh or musical, is thrown back sharp, distinct, absolutely unaltered and scarcely diminished by the distance. At some points these mirror echoes are multiple and yet clear cut and unaltered. Such echoes are devoid of beauty or of interest in the present connection, except that they may serve sometimes to suggest that others of the prismatic and musical variety may be found in the neighborhood. Often, however, the latter, which are more numerous and yet harder to find, are not associated with any sharp or mirror echo. In the spectral echoes all harshness or mere noise disappears; and only the tones and overtones swell and linger hauntingly. They are purer in musical quality than any notes made by an orchestra in a concert hall; they are only to be compared to the reverberations of such an organ, or of a splendid human voice intoning, in such a vaulted and many columned minster as that of Chartres.

Some of the conditions for such acoustic spectra and the rich chords, which come back from the cliffs, when a scale of notes or a bar is shouted at them, seem to be a wall not quite at right angles, very rough and broken, sometimes with several distinct cliffs. Trees are generally present on the talus slopes below the cliffs, and even in crevices and on ledges between the bluffs; but I am doubtful of their playing any considerable part in sorting out the tones and

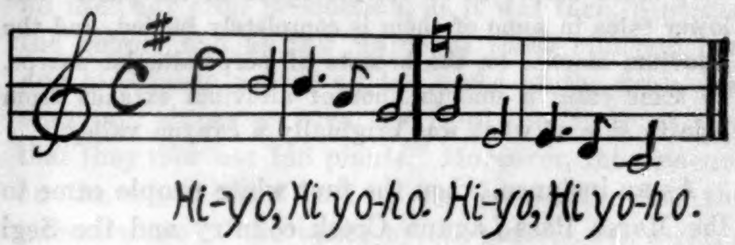
suppressing mere noises. Chiefly it seems to be the direction in which the walls run which acts on the mixed sounds as a prism does on the mixed waves of light; the roughness of the cliffs which acts acoustically as a Rowland grating does optically; and the super-position of several mirror echoes which gives a result analogous to that of a Michelson interferometer.

So far as I am aware, no one has reported these spectral or analyzed echoes as occurring on Mt. Desert, and it is certainly not generally known that the precipitous granite hills carved out by the glaciers in this region are peculiarly rich in these beautiful acoustic properties. They are much more numerous there and easier to elicit than in any other region with which I am acquainted. On the western side of the island I have found only a few spots with spectral echoes, although echoes of the ordinary or mirror type are perfect in at least two places on that side. On the cliff in Somes Sound a very sharply defined mirror echo is well known, but very little prismatic effect is obtainable. At Echo Lake there is also a well-known mirror echo; and there it is only necessary to go a few rods southward from the focus of the mirror echo, in order to obtain a fine spectral effect.

On the eastern half of the island there are no such sharp mirror echoes as those on the western side, for there are fewer smooth, vertical and isolated walls. There are, however, several splendid spectral echoes. The first to be found is on the trail up Jordan Mountain from Asticou, about two thirds of the way up. It comes across a gorge between two ridges. Even finer spectral echoes are obtainable at several places along the upper part of the cliff trail on the eastern face of Jordan Mountain, reflected from Pemetic and the Bubbles. But perhaps the best of all are those on the "goat trail" down the side of Pemetic Mountain to Jordan Pond. Sounds from there are reflected from the broken eastern face of Jordan Mountain and from the Bubbles. These spectral echoes are multiple, a succession of two or three distinct and separate returns.

In calling musical echoes it is best, in my opinion, to sing or rather shout a few successive notes, either a scale or arpeggio. Best of all is a bar of five notes which are associated with the "fire motif" in Wagner's opera of "Die Walküre."

Of course a considerable volume of sound helps; but it is not necessary to strain an ordinary voice; for distinct and repeated returns may be obtained even by a woman's voice. If a man's voice has in it any musical quality at all, the acoustic prism or grating picks out the harmonious elements and suppresses all mere noise. Thus a rather harshly shouted succession of notes comes back rich, sweet and full, again and again, and finally faint and far, but still clear, as if it were the voice of some elf of the mountains way up among the crags.



I can not resist repeating some of the lines of Emerson from the passage which Professor Forbes quotes at greater length. No scientific description could be truer, for the sounds even of a voice of little natural musical quality, as he says:

> Softened are above their will,
> Take tones from groves they wandered through
> Or flutes which passing angels blew.
> All grating discords melt,
> No dissonant note is dealt,
> And though thy voice be shrill
> Like rasping file on steel,
> Such is the temper of the air,
> Echo waits with art and care,
> And will the faults of song repair.
>
> * * *
>
> The artful air will separate
> Note by note all sounds that grate,
> Smothering in her ample breast
> All but godlike words,
> Reporting to the happy ear
> Only purified accords.

I recommend the search for spectral echoes as a delightful motive for scrambles among these and other hills.

YANDELL HENDERSON

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RECENT CHANGES IN THE PLATEAU REGION

THE Plateau region, as used in this paper, refers to the plateau south and east of the Colorado River, extending eastward to the Rio Grande country of New Mexico and southward over the highlands of both New Mexico and Arizona to the Mexican line.

A close observation shows that a deep cutting began in this region some time in the early Pleistocene and continued uninterrupted till probably in the late Quaternary (Recent), when the incising process was arrested. Then there set in a refilling of the valleys which continued till our own time. And the valleys are now incising themselves again at a rapid rate.

Concerning the filling of the valleys, Dutton, who examined the region with Powell, 1878–1880, says:[1]

[1] Dutton, C. F., "Tertiary history of the Grand Canyon districts," U. S. Geol. Sur. Mon. 2, pp. 228, 229; 1882.

> Most of those lateral canyons . . . are slowly filling up with alluvium at the present time, but very plainly they were much deeper at no remote epoch in the past. The lower talus in some of them is completely buried, and the alluvium mounts on the breasts of perpendicular scarps. In some cases a smooth floor of alluvium extends from side to side of what was originally a canyon valley.

As an instance, when the first white people came to the Marsh Pass-Laguna Creek country and the Segi Canyon region in the Navajo country, 174 miles northeast of Flagstaff, Arizona, there was no Laguna Creek. The valley and canyon floors were a vast plain, dotted with lakes and swamps. A U. S. topographic map made of the region in 1881 shows no stream leading out of it. Hunting parties frequented the region to kill ducks in the swamps and marshes; and the government road led through the pass over the marshy flats, hence the name "Marsh Pass." Then Laguna Creek began to cut back from Chinle Creek thirty miles to the eastward. Year by year it extended its possessions till to-day it ramifies every part of the inner valley and the Segi canyons, has drained all the ancient pools, swamps and lakes, and has the whole country cut up with a maze of lateral, straight-walled chasms fifty feet or more in depth. And the Tokas Jay, the stream leading northward up the valley along the road to Marsh Pass from Moenkopi wash, and Pueblo Colorado wash at Ganado, 45 miles west of Fort Defiance, Arizona, will cut up those valleys and destroy their lakes and pools, as Laguna Creek has done in the Kayenta region, unless man brings about some means to stop their devastating process.

Many people, including the geologist, Herbert E. Gregory,[2] believe that the aggrading of the valley floors of this region was due solely to climatic changes—little rainfall and the action of the wind. They also believe that the cutting of the present valley fillings is due in the main to the overgrazing of the region and the making of paths and roads.

The factors above mentioned no doubt aided in building up or degrading the fluviatile valley floors; but it would seem to the writer that possibly the main agent in causing the aggrading of the valley floors was man.

The Hopis (and occasionally the Navajos) of today build dams and ditches to direct the flood waters of the respective washes and also to prevent canyon cutting; also a series of check dams are often built along moderate slopes and along small washes to retard the run-off and to impound water for stock and house use. Occasionally the valley sides are terraced to prevent arroyo cutting. The dams, which are about five feet in height, are of earth and consequently have to be made annually. Though requiring a great amount of work, through this impounding of water and diverting of washes, water is furnished for much of their stock, and over 20,000 acres of land is irrigated.

In the long ago, when this region was densely populated, as has been shown by Messrs. Kidder and Guernsey,[3] and by the writer,[4] each little wash and flat had its village, and the water was carefully husbanded in the irrigation of the necessary fields and was impounded by reservoirs and check dams for village use. At the present time more than 90 per cent. of the flood waters escape down the washes. The escape of the flood water then was nil, and probably this condition existed for thousands of years. As evidence that such damming and diverting of water was practiced by the ancients, fragments of check dams of loosely piled stone arranged on sloping rock benches and on the terraced floors of the washes may be seen near many of the ruins of the ancient cliff houses and villages of this region (and these villages and cliff houses were numerous).

The triangular Laguna Creek area between Marsh Pass and Church Rock, eighteen miles in length and seven miles across its base at Church Rock, contains 202 ruins of villages, and the Cornfields region from Ganado southward down Pueblo Colorado wash valley to Sunrise Springs, a distance of seventeen miles, contains 173 ruins. This reduced the run-off to the minimum. As a result the *débris* brought down from the mesas by washes was left on the fields and deposited as fans over the valley flats. As no water ran down the main channels, they gradually filled up. Wind action no doubt played a part in filling up the valleys. However, there is no evidence that sand dunes were the main factors in closing any part of the streams of the region. On the contrary, their banks are clays, pond deposits (including layers filled with snail shells) and wash material. In time the drainage became wholly blocked, not because of a lack of rain sufficient to carry off the *débris*, but *because man used the accumulating waters for his own use.* Outrushing washes, descending from the higher areas, also now and then pushed their dry fans farther and farther across the region till the valleys were wholly dammed and the excess water impounded in shallow lakes. Then by this same process the valley flats were gradually aggraded. That this valley filling occurred since the coming of the villagers is evidenced by the presence of pottery, corn cobs, kitchen refuse and occa-

[2] "Water resources of the Navajo country," U. S. Geol. Sur., Water Supply Paper 380, 1916, p. 100.

[3] Kidder, Alfred Vincent, and Guernsey, Samuel J., "Archeological explorations in northeastern Arizona," Bulletin 65, Bureau of American Ethnology, Washington, 1919.

[4] Reagan, Albert B., "Archeology of the Tuba-Kayenta region in Arizona," Trans. Kan. Acad. Sci., Vol. 30.

sional walls of rooms, buried beneath the filling of the terraces, now exposed in the banks of the present streams. The villagers and cliff people then left the region. The region then remained in a state of equilibrium as they left it for hundreds of years, except that the ponded areas probably increased in depth and the fluvial, dry ridges increased in height, for, as is well known, an established condition will remain till some excessive influence (change) overwhelms it. Thus the valley aggrading continued. Then the Navajo came with his stock and the white man with his roads and trails. The grass and herbage was short-cropped, and trails led down the valleys and from the mesas and mountains. Moreover, but little or no water was used for irrigation. As a consequence of these changes the rainfall rushed down the almost bare slopes, collected in the trails and rushed on toward a central point in the respective valley. Along these paths (and roads) canyons were cut and permanent channels formed. By these the waters collected in the central area in sufficient volume to commence cutting a channel to a master stream; and this cutting will continue till man again arrests its progress.

In summary, the intensive farming and use of water for irrigation and the reservoiring of every side mountain canyon for village use and for irrigation in the days when the villagers swarmed the land caused the master streams to be filled up and the valleys to be aggraded, a process which continued even to our own time. Professor Gregory says, as we have seen, that a lack of rainfall to a certain limit would cause the valleys to be aggraded. *If, on the other hand, man used the water to that same limit, the aggrading result would be the same.* And the evidence that the cliff-village dwellers did so is unquestionable. Every side wash, canyon and flat had its village or villages, its dams, ditches and reservoirs, as is readily seen by examining the region. The aggrading of the valley floors and the often laking of same was evidently directly due to man's work. This is attested by the fact (1) that the flora and fauna are now the same as when the cliff dwellers lived there, with the exception of what the white man has destroyed since his coming; and (2) that in the sections that have little rainfall now but few villages in the open or in the canyons are found, and these are often small, whether open or cliff ruins, indicating that they were merely hunting-season or summer-outing villages. The evidence adduced is that the climate is the same now as when the villagers lived here. (Of the known 73 species of the living fauna of the region, including birds, 51 of the species have been found in the village-cliff ruins, and probably 40 per cent. of the characteristic living flora of to-day has likewise been found in the *débris* left by those ancient peoples.) Moreover, then and up to thirty years ago all the precipitation was kept in the region, and the rainfall of to-day would sustain a large population if it was all used for crop production, as it was then, provided the people had as few wants as those villagers had and also made use of all the herbs of the fields and mountain slopes as even the Hopis do, it being said that they now use 146 plants. Moreover, the evidence on the whole must lead to the conclusion that the intensive use of the water by the natives was a cause of the aggrading of the valleys. The evidence also further shows that when the conditions of the region were most favorable for the habitation of the villagers, they left it.

The writer also wishes to add this factor to the cause of the aggrading mentioned above. When the villagers dominated the region, which was for hundreds of years, they had no domesticated animals. Moreover, the wild animals of the country were killed off for food and clothing by them. This left nothing to prevent a rather rank vegetation to dominate any part of the region not under cultivation. Grass, weeds, shrubbery and timber was evidently more abundant. As is recognized and advocated by all advocates of keeping up reserving our forests, this prevented a rapid run-off of the water of the summer rains and winter snows, and this, too, aided materially in the valley building which we have been considering. Then the overgrazing in our own time is bringing about a degrading of the same region.

This brings out the fact that a change of elevation in high and moderately elevated regions is not necessary for the streams to begin to incise their channels; but this incising of the streams may be brought about by an overgrazing (deforesting) of the region —by domestic stock of civilized man or by the increasing and incoming of herds of wild beasts. This probably accounts for certain cutting of streams in the past. Then when the beasts had destroyed the vegetation by grazing and had either left the region or starved to death in it, the vegetation sprang up again and the streams began again to aggrade their valley floors. This overgrazing of regions may also account for the extermination of many species in the past. When the edible plants became so destroyed that the beasts could not be properly nourished, they would become diseased and finally exterminated, provided they did not migrate to some other more favorable region, which was not always possible. The aggrading and degrading of valleys and the coming and going (dying) of hordes of herbivorous beasts seem to have a direct relation to each other, but in reverse order. The streams aggraded their valleys when herbivorous animals are few in number, and degrade their valleys when hordes of them are consuming the vegetation.

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CORNFIELDS, GANADO, ARIZONA

SCIENTIFIC EVENTS

THE IMPERIAL FORESTRY INSTITUTE AT OXFORD

THE current number of the *Empire Forestry Journal*, issued by the Empire Forestry Association, Imperial Institute, South Kensington, deals with the establishment at Oxford of an institute which will be known as the Imperial Forestry Institute. According to an abstract in the London *Times*, the question of establishing a central training institution was first discussed by the British Empire Forestry Conference in 1920. This conference felt that, owing to lack of funds and dissipation of effort, training in the higher branches of forestry for the needs of the Empire was nowhere so complete or efficient as was desirable, and therefore recommended the establishment in the United Kingdom of one institution which should undertake the higher training of forest officers, and should also be a center for research into the formation, tending and protection of forests. A committee was appointed to make recommendations regarding the location and organization of such an institution, but it was not until last year that the proposals were endorsed by the Imperial Economic Conference in London, and arrangements made for starting the institute in October, 1924.

The Imperial Forestry Institute will be a university institution, the professor of forestry being its director. It will be under the control of a board of governors, representing the university and government departments concerned, under the chairmanship of Lord Clinton, a forestry commissioner. The educational work of the institute will comprise (1) post-graduate training of probationers for the forest services and of other qualified persons; (2) training of research officers in special subjects, and (3) provision of courses for selected officers already serving.

It is intended that the institute shall maintain close touch with the various forestry training centers throughout the Empire. Thus, in the case of overseas training centers which have no direct means of giving practical instruction in the latest systems of management as practised on the Continent of Europe, it will be one of the functions of the institute to arrange for such practical instruction to be given by members of its own staff to students who have already completed their general course of training at their own universities or colleges. If, in any particular case, it can not undertake to give direct instruction, the institute may arrange that this should be given at some other place.

Although the institute is intended primarily to serve the needs of forestry in the British Empire, it will be open to qualified students of any nationality, provided that there is sufficient accommodation. Nor is it by any means intended that it should cater only for the requirements of state forest services; the institute should, it is believed, be of special value in providing timber and wood-pulp firms with fully-trained employees. Students admitted to the institute may, in fact, be included under any of the following categories:

(*a*) Those possessing a degree in forestry, or a diploma or equivalent certificate of having satisfactorily completed an approved course of training in forestry, who have been selected as probationers for the higher branch of some forest service.

(*b*) Graduates with honors in science, who desire to become specialists in some branch of work connected with forestry.

(*c*) Forest officers deputed to attend courses with the view of bringing their professional knowledge up to date.

(*d*) Students of approved qualifications not included in the first three categories who are admitted on the recommendation of overseas governments.

(*e*) Students with a university training in forestry who may wish to attend the institute on their own account and at their own expense.

The courses of study will normally extend over one academic year. Temporary accommodation for the institute has been arranged, but a more suitable site and larger buildings will be necessary. The university has undertaken to contribute a sum not exceeding £300 a year to the Department of Forestry, in addition to its present contribution. The selection of Oxford has caused considerable misgiving at the other universities in Great Britain which confer degrees in forestry; but the governing council of the Forestry Association are confident that all concerned will unite to make the institute a complete success.

ITHACA MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE sixty-eighth general meeting of the American Chemical Society was held at Ithaca, N. Y., from Monday, September 8, to Saturday, September 13, inclusive. The council meeting was held on the afternoon of the eighth; the general meeting on Tuesday morning, the ninth; the special meeting descriptive of the new Baker Laboratory on the afternoon of the ninth; general divisional meetings on Wednesday morning, the tenth; and special divisional meetings on Wednesday afternoon and Thursday.

On Tuesday evening the members enjoyed an evening of entertainment with a program chiefly drawn from local talent. It was, however, a program of unusual merit and high character.

On Tuesday morning the society was welcomed by President Livingston Farrand, and, after a short response by President Baekeland, the following general addresses were delivered: "Chemistry and civiliza-

tion," by Sir Max Muspratt, United Alkali Company, Liverpool, England; "Serum Globulins," by Professor S. P. L. Sorenson, Carlsberg Laboratory, Copenhagen, Denmark; "The chemistry of the tri-nitrotoluenes," by Sir Robert Robertson, president of the chemical section of the British Association for the Advancement of Science.

On Wednesday night President Baekeland delivered his presidential address, entitled, "Prospects and retrospects." President Farrand was to have spoken on "Science and the nation's wealth," but was confined to bed by illness. Accordingly, the address had to be omitted, much to the regret of all members attending the meeting.

On Friday afternoon some three hundred members took a boat ride to Taughannock Falls and later enjoyed a dinner and dance at Glenwood, Ithaca's most delightful suburban resort.

Friday being Defense Day, President Baekeland sent the following telegram to Major General Amos A. Fries:

> As President of the American Chemical Society, and on behalf of its 15,000 members, I extend to the nation our hearty support of Defense Day and the principles it represents and wish you continuous success in your efforts in the application of chemistry to the country's welfare.

The four general programs by divisions on Wednesday morning were under the auspices of the Division of Chemical Education, Division of Physical and Inorganic Chemistry, Division of Industrial and Engineering Chemistry and the Divisions of Sugar and Cellulose, jointly.

All divisions and sections met.

One thousand and eighty-seven members and guests registered, and 265 papers were presented to the various meetings.

The divisions elected officers as follows:

Agricultural and Food Chemistry: Chairman, C. H. Bailey; Vice-chairman, E. F. Kohman; Secretary, C. S. Brinton; Executive Committee, the chairman, vice-chairman and secretary.

Biological Chemistry: Chairman, R. Adams Dutcher; Secretary, R. J. Anderson; Executive Committee, H. Steenbock, A. D. Holmes, W. R. Bloor, Arthur Knudson, A. P. Lothrop.

Cellulose Chemistry: Chairman, H. LeB. Gray; Vice-chairman, L. E. Wise; Secretary, L. F. Hawley; Executive Committee, Harold Hibbert, G. J. Esselen, Jr.

Chemical Education: Chairman, W. A. Noyes; Vice-chairman, T. G. Thompson; Secretary, B. S. Hopkins; Treasurer and Business Manager, E. M. Billings; Executive Committee, J. D. Hildebrand, H. A. Carpenter, H. R. Smith.

Dye Chemistry: Chairman, R. Norris Shreve; Vice-chairman, J. E. Ambler; Secretary-treasurer, O. E. Roberts, Jr.; Executive Committee, the chairman, vice-chairman, secretary-treasurer, L. H. Cone, I. W. Fay.

Fertilizer Chemistry: Chairman, F. B. Carpenter; Secretary, H. C. Moore.

Industrial and Engineering Chemistry: Chairman, W. A. Peters, Jr.; Vice-chairman, W. H. McAdams; Secretary-Treasurer, E. M. Billings; Executive Committee, C. E. Coates, W. K. Lewis, S. W. Parr, E. R. Weidlein, Robert McKay.

Leather and Gelatin Chemistry: Chairman, John Arthur Wilson; Vice-chairman, L. R. Ferguson; Secretary, Arthur W. Thomas; Executive Committee, J. H. Cohen, W. H. Irwin.

Medicinal Products: Chairman, E. H. Volwiler; Secretary-Treasurer, H. A. Shonle; Executive Committee, O. Kamm, E. B. Carter.

Organic Chemistry: Chairman, J. A. Nieuwland; Secretary, Frank Whitmore.

Petroleum Chemistry: Chairman, R. R. Matthews; Vice-chairman, R. E. Wilson; Secretary, G. A. Burrell; Executive Committee, W. F. Faragher, C. O. Johns.

Physical and Inorganic Chemistry: Chairman, Arthur E. Hill; Vice-chairman, Harry B. Weiser; Secretary, G. S. Forbes; Executive Committee, Graham Edgar, James Kendall, W. C. Bray.

Rubber Chemistry: Chairman, C. R. Boggs; Vice-chairman, J. M. Bierer; Secretary, A. H. Smith; Executive Committee, E. H. Grafton, E. B. Spear, Frank Kovacs, L. B. Sebrell, A. A. Somerville.

Sugar Chemistry: Chairman, W. B. Newkirk; Vice-chairman, H. W. Dahlberg; Secretary-Treasurer, Frederick Bates; Executive Committee, C. E. Coates, Chairman, W. D. Horne, S. J. Osborn, H. Z. E. Perkins, J. R. Withrow, H. E. Zitkowski.

Water, Sewage and Sanitation: Chairman, F. W. Mohlman; Vice-chairman, T. G. Thompson; Secretary (to be elected later); Trustees, W. F. Langlier, A. M. Buswell.

CHARLES L. PARSONS,
Secretary

MEETING OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

MEMBERS of the American Institute of Mining and Metallurgical Engineers will make a ten-day inspection of the mining and metallurgical industries of the south, leaving Washington, D. C., on October 7, and stopping at Birmingham, Ala., on October 13, for the 130th meeting of the institute, which will last three days.

England will send as its representative, to accompany the American engineers, Sir William Ellis, president of the British Iron and Steel Institute, who will arrive in this country early in October. Sir William's presence is the response of British engineers to the action of the American engineers in commissioning Charles F. Rand, of New York, head of the Engineer-

ing Foundation, to a recent meeting of the British Institute in London.

Expressing the development of a conscious policy of closer relations with the engineers of other countries, the American Institute, through its president, William Kelly, of Iron Mountain, Mich., has sent a message to the British engineers expressing appreciation of their generosity "in placing the results of their scientific labors at the disposal of the entire world."

The mining engineers will journey from Washington by special train, stopping at the Caves in the Shenandoah Valley, the Pocahontas coal fields, the Mascot zinc mines, the Tennessee marble quarries, Copperhill, Ducktown and the battlefields of Chattanooga. October 13, 14 and 15 will be spent at Birmingham. The return to Washington will be via Sheffield, Ala., where the Wilson Dam and power plant are nearing completion.

Papers to be presented at the Birmingham technical sessions will deal chiefly with the industries centered around the points to be visited. Speakers and their topics will include: Wilbur A. Nelson, Nashville, "Geology of the Mascot (Tennessee) zinc deposits" and "Geology of the east Tennessee copper deposits"; Robert Ammon, New York, "Milling practice at Mascot"; H. A. Coy, Brooklyn, N. Y., and J. A. Nobel, Mascot, "Mining methods at Mascot"; Milton H. Fies, Birmingham, "Alabama coal mining practices"; Henry S. Geismer, Birmingham, "Blast furnace practice in Alabama"; T. L. Joseph, Minneapolis, "Effect of sulphur in blast furnace practice"; Theodore Swann, Birmingham, "Production of ferro phosphorus in the electric furnace"; Richard Moldenke, Watchung, N. J., "Manufacture of cast iron pipe in the south"; James Bowron, Birmingham, "The Alabama steel industry."

THE CENTENARY CELEBRATION OF THE FRANKLIN INSTITUTE

THE centenary celebration of the founding of the Franklin Institute and the inauguration exercises of the Bartol Research Foundation were held in Philadelphia on September 17, 18 and 19 in accordance with the program that has been printed in SCIENCE. Dr. William C. L. Eglin, the president of the institute, presided, and the arrangements were in charge of Professor Gellert Alleman, vice-president of the institute and chairman of the executive committee.

At the first general meeting on the morning of September 17, the delegates and guests assembled at the Hall of the Franklin Institute and were welcomed at the Walnut Street Theater by the mayor of Philadelphia. Addresses were made by President Eglin and Dr. Elihu Thomson, honorary chairman of the centenary celebration, who reviewed the history of the institute, in connection with which some of his earlier scientific work had been done. At an open meeting on the evening of September 18, Professor Sir Ernest Rutherford, of the University of Cambridge, gave an address on "The natural and artificial disintegration of elements."

On the morning of September 19, a tablet was unveiled at the Bartol Research Foundation in its temporary buildings facing the Academy of Natural Sciences. Mr. C. C. Tutwiler, vice-president of the institute, presided and made an address, and the tablet was unveiled by a grandniece of the donor, who bequeathed to the institute a sum in excess of a million dollars for research in fundamental problems of physical science and for investigating scientific problems that may arise in industry. Following the unveiling of the tablet a general session was held at the Academy of Natural Sciences with addresses by Dr. Arthur D. Little, of Cambridge, and Dr. D. S. Jacobus, of New York.

There were daily luncheons at the Bellevue-Stratford, a garden party on the afternoon of September 18, and a banquet for delegates and guests on the evening of September 19. Among the speakers at the banquet were Sir Ernest Rutherford for the British Empire, Professor Charles Fabry for France, and Professor F. Haber for Germany. Greetings were presented from a large number of representatives of universities and colleges and of learned and professional societies.

At the sectional meetings held on September 17, 18 and 19, there was a distinguished list of speakers, which included Professor Joseph S. Ames, Professor Wilder D. Bancroft, Professor Sir William H. Bragg, Professor William L. Bragg, Professor P. W. Bridgeman, General John J. Carty, Professor E. G. Coker, Dr. William D. Coolidge, Director Arthur L. Day, Professor F. G. Donnan, Dr. William Leroy Emmet, Professor Charles Fabry, Professor F. Haber, Professor W. J. Humphreys, Brigadier-General Edgar Jadwin, Dr. George L. Kelley, Professor A. E. Kennelly, Dean Dexter S. Kimball, Dr. Irving Langmuir, Professor C. H. Mathewson, Dr. C. E. K. Mees, Professor Charles E. Mendenhall, Professor A. A. Michelson, Professor Dayton C. Miller, Professor W. Lash Miller, Dr. Ralph Modjeski, Mr. Daniel E. Moran, Sir Charles Algernon Parsons, Major-General Mason M. Patrick, Dean Harold Pender, Mr. F. W. Peek, Director Charles L. Reese, Dr. E. W. Rice, Provost Emeritus Edgar F. Smith, Dr. Frank J. Sprague, Major-General George O. Squier, Professor Julius Stieglitz, Professor Bradley Stoughton, Professor W. F. G. Swann, Professor John Sealy Edward Townsend, Professor Augustus Trowbridge, Major-General C. C. Williams and Professor Pieter Zeeman.

SCIENTIFIC NOTES AND NEWS

THE University of Pennsylvania held a special convocation on the occasion of the Franklin Institute centenary, when President J. H. Penniman conferred the honorary degree of doctor of science on the following delegates: Sir William Henry Bragg, London; Dr. William Charles Lawson Eglin, chief engineer of the Philadelphia Electric Company and president of the Franklin Institute; Dr. Charles Fabry, Paris; Sir Charles Algernon Parsons, British engineer; Dr. Edwin Wilbur Rice, Jr., honorary chairman, of the General Electric Company, and Dr. Pieter Zeeman, Amsterdam.

OFFICIAL representatives of the United States have been appointed by the Department of State for the third Pan-American Congress at Lima, Peru, from December 20 to January 6, as follows: Dr. Leo S. Rowe, president of the American Academy of Political and Social Sciences, chairman; Dr. Albert Sauveur, professor of metallurgy at Harvard University; Professor Marshall H. Saville, Museum of the American Indian, Heye Foundation, New York; Dr. A. A. Michelson, president of the National Academy of Sciences; A. W. Whitney, chairman, American Engineering Standards Committee, New York; Dr. John D. Long, assistant surgeon general, United States Public Health Service; Dr. Vernon Kellogg, secretary of the National Research Council, Washington, D. C.; James Brown Scott, president of the American Institute of International Law, Washington, D. C.; Dr. Samuel McCune Lindsay, professor of social legislation, Columbia University; Dr. Rufus B. Von Kleinsmid, president of the University of Southern California, Los Angeles, Calif.

DR. ROBERT J. WILSON, director of the bureau of hospitals, Department of Health, New York City, was presented with an illuminated autograph token of esteem by the employees of that bureau and the bureau of laboratories, on his recent retirement as director following twenty-eight years of service.

PROFESSOR W. E. S. TURNER, secretary of the Society of Glass Technology, Sheffield, England, was the guest of honor at a dinner given by the members of the Pittsburgh section of the American Ceramic Society at the University Club on September 4.

DR. SAMUEL BENJAMIN JONES, a West Indian, who received his medical education in the United States, has been awarded by King George the order of Member of the British Empire in recognition of meritorious services rendered in combating a smallpox epidemic in the British West Indies in 1923.

DR. E. O. HULBURT, formerly associate professor of physics at the University of Iowa, has been appointed superintendent of the division of heat and light of the Naval Research Laboratory, Washington, D. C.

ELWOOD MEAD, professor of rural institutions at the University of California, has been appointed commissioner of the Bureau of Reclamation, U. S. Department of the Interior.

H. G. SCHURECHT, ceramic engineer at the Mellon Institute, Pittsburgh, has accepted a position with the Bureau of Standards.

GEORGE H. CONANT, formerly of the department of botany at the University of Wisconsin, has resigned to take charge of the division of botany of the General Biological Supply House, Chicago, and Dr. D. L. Gamble, assistant professor of zoology at Cornell University, has resigned to take charge of the division of zoology.

DR. THURMAN B. RICE has been appointed director of the laboratory of bacteriology and hygiene of the state board of health of Indiana, to succeed Dr. Alfred G. Long.

THE following appointments have been made by the Eastman Kodak Co., Rochester, N. Y.: Dr. R. H. Lambert, Ph.D. (Mass. Institute of Technology), in the research laboratory; Dr. Cyril J. Staud, Ph.D. (Mass. Institute of Technology), in the organic research department; Dr. Otto Sandvik, Ph.D. (Northwestern University), in the department of physics. Mr. Merrell Seymour has accepted a position in the photographic department of the research laboratory.

DR. WILHELM DEECKE, professor of geology and paleontology and director of the Geological Institute of the University of Freiburg, has resigned his position as director of the Geological Survey of Baden.

DR. JOHN K. SMALL, head curator of the museums of the New York Botanical Garden, returned on July 30 after a three weeks' visit to Florida, mainly in search of irises (with special reference to finding the fruits), papaws and plants of other critical genera and species.

N. E. HANSEN, agricultural explorer of South Dakota, is leaving on his sixth trip to Siberia in search of fruits and plants adaptable to the climate of the Northwest.

DR. HERBERT J. WEBBER, professor of subtropical horticulture and director of the Citrus Experiment Station of the University of California, has gone to South Africa, where he will spend the next year under a commission from the government of the Union of South Africa to study and prepare a report on the citrus and cotton growing industries of that country. His headquarters will be at the Department of Agriculture, Pretoria, Transvaal. Before leaving Europe

he will make a short study of orange-growing methods in Spain.

Dr. B. E. Lischer, professor of orthodontics at the Washington University Dental School, gave a series of lectures on orthodontics at the University of California from August 25 to September 4.

A portrait bust in bronze of Louis Pasteur was dedicated on September 16 at the American Institute of Baking. The bust was presented by Helge Jacobsen, director of Carlsberg Glyptotek; Vagn Jacobsen, director of Carlsberg Brewery, and the Carlsberg Fund, Poul C. Poulsen, director, Copenhagen, Denmark.

Dr. John Martin Schaeberle, formerly astronomer at the Lick Observatory, has died at the age of seventy-one years.

Dr. Charles W. Moulton, head of the department of chemistry at Vassar College, died on September 13, aged sixty-five years.

Dr. Albert Haworth, recently appointed lecturer in pathology at the University of Leeds, England, died on September 8, at the age of thirty-six years.

Dr. Alfred Bergeat, professor of mineralogy and director of the Mineralogical Institute of the University of Kiel, has died, aged fifty-eight years.

Dr. Koloman v. Szily, emeritus professor of physics at the Budapest Polytechnic School and formerly the general secretary of the Hungarian Academy of Sciences, has died at the age of eighty-six years.

The thirty-fifth annual general meeting of the Institution of Mining Engineers of England will be held at the Conference Halls of the British Empire Exhibition on Thursday and Friday, October 2 and 3. Sir John Cadman will relinquish his third term of office as president on October 2, when he will be succeeded by Dr. J. S. Haldane, director of the Mining Research Laboratory and honorary professor in the University of Birmingham.

The zoological department of the Vienna Museum of Natural History opened recently a collection of insects having a bearing on medicine, according to the Vienna correspondent of the *Journal* of the American Medical Association. The whole exhibit, divided into six groups, shows which of these organisms exerts a disease-producing action on human beings or animals (1) by means of the secretions of its glands, (2) by means of hairs, (3) by poisonous appendages, (4) by sucking the blood, (5) by parasitism, or (6) by transmitting disease germs. The entire life cycle of these organisms, as far as it is known, is shown in a series of specimens arranged so as to reproduce the natural conditions, and short but concise explanations are placed in each receptacle. The organisms that are too small to be well visible with the naked eye are represented in colored photographic enlargements. Once a week expert guidance is provided. The entire collection comprises about 6,000 specimens.

The Pasteur Institute has set up in the island of Los, near Konakri, in French Guinea, a "farm" for the breeding and preservation of apes and monkeys required for medical experimental purposes. This is a large, well-watered, woody fertile tract of land near a forest inhabited by chimpanzees and several species of monkeys. A director has been appointed, and the necessary outbuildings constructed. These include accommodation for sick animals.

In order to determine the suitability of foreign trees for introduction into this country, arboretums in which groups of such "immigrant" species can be tried out are being established by the United States Forest Service in several of the forest regions. At Wind River 60 miles from Portland an arboretum of this sort has now some seventy-five different alien species of trees growing in small-sized groups or clumps. These trees are carefully watched by members of the Pacific Northwest Forest Experiment Station, which has a branch station at Wind River, and their growth and general development and ability to become acclimatized are studied. Local records of climate and soil conditions are also maintained.

UNIVERSITY AND EDUCATIONAL NOTES

The Tulane University of Louisiana School of Medicine, New Orleans, has announced plans for the establishment of a chair of tropical medicine, made possible by a bequest of $60,000 from William E. Vincent.

In addition to the sum of $110,000 bequeathed to the Western University Faculty of Medicine, Ontario, by Dr. Friend R. Eccles, $200,000 will become available after the lifetime of two relatives.

An anonymous donor has given funds to the University of Chicago for the maintenance of a research fellowship in preventive medicine for two years.

New appointments at the Johns Hopkins University include Dr. F. O. Rice, formerly of the University of Liverpool, in physical organic chemistry, and Dr. F. Russell Bichowski, research associate at the University of California, in thermodynamics.

At the University of Virginia the following appointments have been made: Dr. Bruce D. Reynolds, Ph.D. (Johns Hopkins, '24), assistant professor of zoology, Dr. Arthur F. Benton, national research fellow at the California Institute of Technology, assistant professor of chemistry, and Dr. A. A. Pegau,

Ph.D. (Cornell), acting assistant professor of geology. Resignations include Dr. Graham Edgar, professor of chemistry, Dr. J. T. Lonsdale, assistant professor of geology, Dr. W. S. Keister, assistant professor of public health, and Dr. B. B. Hershenson, assistant professor of physiology and biochemistry.

DR. NICHOLAS M. ALTER, instructor in internal medicine at the University of Michigan Medical School, Ann Arbor, has been appointed professor of pathology at the University of Colorado School of Medicine, Denver.

THE vacancy in the University of Texas College of Pharmacy, caused by the death of Dr. Raoul R. D. Cline, has been filled by the appointment of William F. Gidley, professor of pharmacy at Purdue University.

DR. GEORGE N. BAUER, formerly professor of mathematics at the University of Minnesota, and recently president of a Minneapolis bank, has been appointed associate professor of mathematics at the University of New Hampshire.

DR. RAYMOND O. FILTER, assistant professor of psychology at the University of Minnesota, and Dr. Homer B. Reed, professor of psychology and education at Grinnell College, have each been appointed to an assistant professorship of psychology at the University of Pittsburgh.

AT Pomona College, Dr. Paul Atwood Harvey has been appointed assistant professor of botany, and Francis G. Gilchrist, instructor in zoology.

DR. CHESTER HAMLIN WERKMAN, research bacteriologist at Iowa State College, has been appointed assistant professor of microbiology at Massachusetts Agricultural College, to succeed Dr. Itano, who has returned to Japan.

DR. D. P. D. WILKIE, lecturer in clinical surgery, has been appointed to the chair of surgery at the University of Edinburgh for a period of ten years.

DR. JULIUS WATJEN, prosector at the hospital of Barmen, has been appointed professor of pathology and director of the laboratories of the Pathological Institute of the University of Berlin.

DISCUSSION AND CORRESPONDENCE

PLANT CLASSIFICATION IN ELEMENTARY BOTANICAL TEXTS

IN a recent number of SCIENCE[1] Professor D. H. Campbell takes to task the authors of some of our current botanical texts, citing in particular a recent book by the present writer, for their conservatism in still accepting the same primary divisions of the plant kingdom which were in use fifty years ago, and asks whether this is due to ignorance or merely to indifference. In view of the fact that this system of classification (which divides the plant kingdom into four main groups, the Thallophytes, Bryophytes, Pteridophytes and Spermatophytes) is employed in most of the texts in common use to-day, one is tempted to suspect that there may be other reasons for its persistence than those which Professor Campbell suggests. Two of these reasons the writer desires to mention here.

First, such a method of presenting the plant kingdom to an elementary student has important pedagogical advantages. The author of an elementary text must, of course, be cognizant of the results of modern research, but his chief problem is to present these results without overwhelming the beginner by an array of discouraging complexities. It is now clearly recognized, for example, that the so-called Thallophytes are a very heterogeneous assemblage of plants and include a large number of diverse groups which represent more or less independent evolutionary lines and may not be closely related to one another. All Thallophytes, however, have certain fundamental characters in common, and stand at an evolutionary level quite distinct from that of the higher groups. The teacher who wishes to acquaint a beginner in botany with the salient features of the plant kingdom as a whole and who is allotted but a short time in which to do so will have the best chance of success if he treats the Thallophytes as a single great, though admittedly heterogeneous, group, emphasizing the resemblances among them rather than the differences, and pointing out the main features whereby they may be distinguished from the other major divisions. Similarly, the Bryophytes, Pteridophytes and Spermatophytes are probably not strictly monophyletic groups, but each nevertheless has certain points in common by which it may be readily distinguished and its position in the plant kingdom fixed.

We may fairly expect the elementary student to become familiar with four major groups, but if we ask him to learn twenty or thirty of these we must plan to devote to this end the bulk of the entire course. Elementary college courses of this type, commonly in vogue half a century ago, no longer meet the need for progressive botanical instruction, and one is inclined to ask whether their occasional survival is the result of conservatism or merely of bad pedagogy. There is a widespread conviction to-day that elementary botany should stress the plant as a living organism rather than simply the product of an evolutionary process, and our major effort must therefore be first to acquaint beginners with the im-

[1] Campbell, D. H., "A question of classification," SCIENCE, 55, 64–65, July 18, 1924.

portant principles of morphology and physiology. The comparatively limited instruction in classification for which the first-year student has opportunity should not primarily aim to teach him phylogeny—the province of more advanced courses—but rather to familiarize him with the main features of the plant kingdom as it now exists, explaining briefly those great steps in evolutionary progress which have brought plants to where they are to-day. Has not an over-emphasis of phylogenetic detail been one of the reasons for the fact that botany to-day fills a much less conspicuous place in college curricula than its intrinsic importance warrants?

Secondly, an elementary text can not well present a given conclusion as fact until it has achieved essentially universal acceptance. Professor Campbell seems to imply that there is agreement as to the main facts of plant relationship; but certainly the conclusions which he cites and assumes to be established with regard to the interrelationships of the so-called embryophytes (Bryophytes, Pteridophytes and Spermatophytes) will by no means find unanimous consent to-day. Most botanists would probably agree that "comparative morphology . . . is the safest clue to relationships," but to base conclusions chiefly upon the structure of the reproductive parts alone, as does Professor Campbell, disregards a very important source of phylogenetic evidence and has often resulted in erroneous conceptions. Much attention, particularly during the past twenty years, has been devoted to another branch of comparative morphology, that which deals with the *vegetative* parts of the plant body, and the modern student of evolution draws his conclusions from *both* these important sources. This broader method of phylogenetic investigation has led to the conception of the plant kingdom as divided into two main groups, the non-vascular plants (Thallophytes and Bryophytes) and the vascular plants (Pteridophytes and Spermatophytes). Certainly between these two major divisions there are such profound differences in structure and function that it is hard to see how a student of evolutionary history can look upon the embryophytes as a very homogeneous group. Surely between mosses and ferns there are such fundamental divergences, if one is willing to consider all the facts, as to warrant the statement made by the writer, which Professor Campbell finds "astonishing," that "in passing from the Bryophytes to the Pteridophytes . . . we cross the widest gap which exists in the continuity of the plant kingdom." For years botanists have been unsuccessfully endeavoring to establish a bridge over this gap, and the author's reference, cited by Professor Campbell, to the most plausible connection (through the Anthocerotales) by no means implies that the gap is other than a very wide one indeed. It is hard to arrive at an estimate of opinion in such a matter as this, but the writer feels confident that a very considerable group of botanists will by no means regard as "an unscientific and outgrown system of classification" that which places liverworts closer to algae than to angiosperms, but will look with suspicion upon any system which is based largely upon the study of only one group of organs.

All these problems of phylogeny look more complex to-day than they did in the first flush of evolutionary enthusiasm, and we realize that their solution must involve a thorough study of anatomy, genetics, paleobotany and other branches of botanical science; and that it can not be based, as so often in the past, merely upon evidence derived from the reproductive structures alone. When facts from all sources have been sifted and botanists have agreed as to the fundamentals of plant classification, then it may be time to present phylogenetic conclusions to freshmen in more dogmatic form; but until that day arrives, there is much to be said in favor of a continued use in our elementary texts of that system which has so long met with favor at the hands of those who are entitled to speak with authority in matters of botanical pedagogy.

Edmund W. Sinnott

Connecticut Agricultural College

CHESTNUT TREES SURVIVING BLIGHT

When the chestnut blight (*Endothia parasitica*) became prevalent some years ago it seemed that *Castanea dentata* was doomed. Some suggested that a few resistant trees might remain. The writer has followed the course of the disease with great interest and in recent years his observations made him believe that there was a general lessening in the amount of branches killed per year, while the amount of new growth gradually overbalanced that killed.

Accurate data appeared rather difficult to secure; a measurement of new growth compared with that growth killed during the same year was an obvious index but one requiring considerable labor. Any element of choice should be excluded. From extensive field work in connection with an ecological problem it appeared that any normal area on a given soil type could be taken safely, and in such an area a twenty-meter quadrat was laid out near the middle of a woods. This woods was twenty-year-old second growth, of which the chestnut trees (10 in the quadrat) had been killed and sprouts produced from the base while 14 seedlings had come up and were now from 0.5 to 2.5 m in height. The new growth was measured and found to total 152.60 m. Assuming an average cross-sectional diameter of 0.0035 m for the twigs, the total volume of new twig-tissue produced was $0.001456 m^3$. Measuring the blighted wood in the same

way, it was found to total 0.000079m^3. It is seen that the amount of new growth is 18 times that killed in the same year.

Not only are saplings showing recovery of growth but older trees as well. Near the writer's home is a fine grove of chestnut trees of 30 to 40 years age; the tops were killed, but the trees are producing new crowns, in some cases recovering half their former height, and are now well set with fruit.

This condition seems common in southeastern Pennsylvania, the trees flourishing more on Chester and Manor soils than on the more sterile Dekalb. It may also be rather a widespread condition, for in passing through the mountains from Harrisburg, Pa., to Buffalo, N. Y., many trees were seen similar to those described. In the Niagara Peninsula of Ontario, especially near St. Catharines, recovery seemed evident.

The improved condition may not be due wholly to greater resistive powers but to a lessened supply of spores, for it is evident that the total production of *Endothia* spores is vastly lessened. The trees have also shown their ability to heal serious cankers, although ultimate recovery is not a necessary consequence.

Those trees, however, which seem most likely to survive and produce seed are in danger of extinction, since the public has been educated to believe that cutting of all chestnut trees from a woodlot is a virtue. Instead living ones should now be preserved. It might prove advisable to locate the best groves and to protect them from cutting and from fire.

ARTHUR PIERSON KELLEY
RUTGERS UNIVERSITY

THE SCIENTIST AND AN INTERNATIONAL LANGUAGE

ON reading the article of Dr. R. G. Kent on "The Scientist and an International Language" (SCIENCE, No. 1538, June 20) I am particularly glad to hear from a scientist of an English-speaking nation, of the need of an international language for scientists. I fully agree with Dr. Kent in discarding any existing national language as such. I want to call attention to a great handicap on the part of scientists belonging to a nation whose language is not widely intelligible. For instance, in the *Annotations Zoologicae Japonenses* and the *Folia Anatomica,* both published by Japanese biologists, all articles written in Japanese are excluded, and the editors of the Swedish journal *Acta Zoologica* will not accept papers written in Swedish. It is true that for some scientists writing in other languages this may not be felt as a serious handicap. But it remains true that some have the advantage of publishing papers in the mother language, while others have the disadvantage of endeavoring to write in a foreign language.

Dr. Kent proposes the use of Latin as an international auxiliary language among scientists. This was proposed by Zamenhof in his boyhood half a century ago. He soon discarded it, however, because of the extreme difficulty of learning that complicated language, and after years of painstaking effort he finally succeeded in inventing a language, which is now well known by the name of Esperanto.

It is not necessary to explain how easy it is to learn Esperanto, and how freely one can express one's opinion and can describe what he has in mind, even in scientific terms. Every Esperantist will tell you of it. For this reason it would not be desirable to adopt Latin as the spoken language in an international congress. Even if "we give Latin a preferred place in our study of foreign languages" I wonder how many of us would succeed, after a few years' course, in speaking Latin! Esperanto has already experienced a brilliant success in this respect. I believe that it is Esperanto that fulfills our desire of having a neutral auxiliary language in scientific circles.

I may be allowed to add, further, that in Japan some original papers have already appeared in this language in the fields of anatomy, pathology and veterinary science, and that there is a project among a few biologists of publishing an Esperanto bulletin of zoology. This, together with the fact that there exist international as well as local Esperantists' associations in the medical sciences and that several journals are published by them, is sufficient to show the practicability of this language in scientific publications.

HIROSHI OHSHIMA
KJUSU IMPERIA UNIVERSITATO,
FUKUOKA, JAPANUJO

BALL LIGHTNING

IN SCIENCE for August 8, Mr. W. J. Humphreys, of the U. S. Weather Bureau, requests information as to ball lightning.

Several years ago my home was struck by lightning. A ball of fire seemingly about nine inches in diameter was thrown into the center of my bedroom and exploded with a terrific noise, just as if a bomb had been exploded. Brilliant particles seemed to have been hurled into every direction, but I felt no effect other than that of sound and sight.

The electric wires throughout the house were affected, and there is an inch hole through the plastered wall on the ground floor where an electric spark seems to have found its path between the radiator in the room and the metal support to the water spout on the outside of the building.

I took the matter up with Dr. T. C. Mendenhall, with whom I was associated on the board of trustees of Ohio State University, and on expressing a doubt

as to my observations, I was assured by him that in his study of lightning for many years he had come across similar phenomena and that he felt sure that my observations had been correct.

John Kaiser

Marietta, Ohio

SWARMING OF DESERT MILLIPEDS

A question should be placed with "A note on migration of Myriapoda," in Science for July 25, 1924, regarding the identification of the "black objects" encountered in the desert of New Mexico as centipedes of the genus Scolopendra. Black centipedes are not known, but large black millipeds, commonly referred to the genus Spirostreptus, are widely distributed in the desert regions of western Texas, New Mexico and Arizona. The period of the summer rains is the breeding season of these animals, and in damp weather they often emerge in large numbers from the burrows of the desert rodents, though seldom seen at other times. That the "black objects" were not examined closely is indicated by the statement that "we stopped just long enough to notice that these objects were centipedes."

O. F. Cook

Bureau of Plant Industry,
U. S. Department of Agriculture

SCIENTIFIC BOOKS

The Unstable Child. By Florence Mateer. New York, D. Appleton and Co., 1924, pp. xii + 471.

Dr. Mateer's book is a fairly complete manual for the administration of a psychological clinic, and there has been no book covering this important field as such. Furthermore, it contains the first review of psychometric methods that is at once broad and critical. These features themselves suffice to put it in the "indispensable" class for clinical psychologists for some time to come. The title might denote a book from the more strictly clinical viewpoint, rather less concerned with the administrative and research aspects of the topic. It is by no means devoted to case studies of conduct problems.

There are many useful suggestions on the conduct of psychometric examinations. On this matter the differing accounts of experts probably reflect the methods by which they personally get the best results, and as their personalities differ, so do the methods they sponsor. Dr. Mateer ranges herself with the advocates of year scale rather than point scale principles. A strong case is made out for giving the Binet type of scale according to topical categories, *e.g.,* all the "comprehension" tests together, instead of, for example, by years. Goddard is credited with first appreciating the significance of "scatter," which is apparently quite correct, though the date of the reference cited, 1921, is later than several other publications on the point.

It is some years since Dr. Mateer first announced psychometric findings distinctive for congenital syphilis. A chapter is devoted to this matter, on which the author stands firmly to her guns. Generally inferior motor ability stood out clearly; the group are better in imaginal and verbalistic functions, and less good in "motor control and kinesthetic appreciation." There is fairly detailed presentation of the data, and Dr. Mateer apparently feels that the mental criteria can be given positive weight equal, if not prior, to serological methods.

The style of the book is more vivacious than is usually associated with such themes. At the same time there is no tendency to minimize the difficulties of the problems, or to arouse exaggerated expectations. The viewpoint is broad, and there are several entertaining philosophical reflections.

From the point of view of case presentation, a middle course is steered between considerable detail with few individuals, and a less full but more comparative treatment of larger numbers. Both types of presentation are illustrated, but the book would probably gain by additional presentations of the order chapter XI, devoted to the history of a single case. The medical aspect of the topic is not overstressed; the circumstances under which the material was derived were hardly conducive to error in this direction. Considerable stress is laid on the concept of "psychopathy," a term in psychiatric usage differential with feeble-mindedness, and the further distinction of the two concepts is a useful one. The second part of the book is indeed entitled "The Practice of Psychopathy" which, like the title of the whole book, is somewhat beside the mark; happily it does not denote a vade-mecum *für Irrsinnige, oder solche, die es werden wollen.*

Dr. Mateer's early training was in an environment dominated by one with all the contempt of genius for conventionalities of diction. The influence seems to survive in a few such expressions as torpitude and encroachage. Did the author's illustrious preceptor also use rule of thumb to denote meticulousness, disinterested as equivalent to uninterested, data with a singular verb, and write aufgabe thus, like a word of English? Dr. Mateer warns that accumulations of elaborate apparatus and "engraving-like beauty in written reports" are at times compensations for deficiencies of clinical capacity and judgment. So may these rhetorical peccadilloes be themselves but the foil of high excellence and trustworthiness in more vital things.

F. L. Wells

Boston Psychopathic Hospital

SPECIAL ARTICLES

NEW MEASUREMENTS OF PLANETARY RADIATION

IN view of the fact that the popular press has not yet reached such a stage of reliability that one can turn to it for accurate information on scientific subjects this seems an appropriate time and place to record some of the results of our recent measurements on the radiation emitted by the major planets.

Continuing our measurements of 1922, by means of suitable transmission screens the planetary radiation, which consists of wave lengths of 8 to 14 μ, has been successfully separated into spectral components. In this manner it is possible to determine the shape of the spectral energy curve of that part of the planetary radiation which is transmitted by our atmosphere and thus form an estimate of the temperature of the planetary surface.

In the case of Mars, these radiometric measurements show that the equatorial zones are much warmer than the polar regions which emit practically no planetary radiation; the morning side of the planet is at a lower temperature than the afternoon side which has been exposed to the sun's rays for a longer time; the dark regions are at a higher temperature than the light ones, and a gradual rise in temperature of the surface of the southern hemisphere, where summer is now advancing, was recorded.

Tests were applied showing that there is an excess of incoming low-temperature radiation from the planet over the outgoing radiation from the radiometer receiver, which could not occur if the temperature of the effective radiating surface of Mars were at a lower temperature (15° C.) than the receiver.

A direct comparison was made of the spectral components (λ 8–12.5 μ and λ 12.5–5 μ) of the planetary radiation from Mars with similar measurements on the moon, which is commonly supposed to have a temperature of 50 to 100° C. or even higher. This with two other methods of comparison indicate that the temperature of Mars, under a noonday sun, is up to 20° C. or even higher.

In the case of Venus not only does the illuminated crescent show the presence of considerable planetary radiation, but the unilluminated part of the disk also emits a large amount of infra red rays. The planetary radiation (per unit surface) from the unilluminated part of the disk amounts to about 10 per cent. of the total radiation from the brightly illuminated crescent. This radiation is highly selective, the spectral component of wave lengths λ 8–12.5 μ being over 60 per cent. of the total planetary radiation measured.

W. W. COBLENTZ,
C. O. LAMPLAND
FLAGSTAFF, ARIZONA

THE EXPERIMENTAL REVERSAL OF POLARITY IN PLANARIA

THE establishment of polarity is a universal and fundamental phenomenon among organisms, and since it must precede all further differentiation it is important to understand just what is the basis of polarity itself. Although polarity shows itself as a matter of visible structure, it is probably fundamentally a dynamic phenomenon, the visible polarity being the expression of the physiological activities of the individual; this expression should therefore be capable of reversal if the controlling activities are reversed. Polarity is most susceptible of analysis through regeneration experiments on simple, axiate forms such as Tubularia or Planaria, which have consequently been much used in its study. Both of these forms are definitely polarized along an axis, and this polarity ordinarily reappears in the regeneration of an isolated piece of the body.

Both Morgan[1] and Loeb[2] considered polarity as dependent upon definite organ-forming substances, Morgan postulating a gradation of hydranth-forming substance in the stem of a tubularian and Loeb a condition in the protoplasm "of the nature of a current (*e.g.*, of liquid) by which certain substances were carried through the stem." Mathews[3] reported differences of electrical potential between the anterior and posterior cut surfaces of a stem of hydroid and believed these differences to be due to unequal degrees of protoplasmic activity at different regions.

Child's gradient theory[4] regards polarity as an expression of a gradient along the polar axis. This gradient is susceptible of measurement as a gradation in rate of metabolism, in differences of electrical potential at different points along the axis, or in other ways. Miss Hyinan[5] has shown that the anterior end of an isolated piece of a planarian, which is undergoing metabolism more rapidly than is the rest of the piece, is electronegative, galvanometrically, to the posterior end, where the rate is lower. There is a certain stimulation of metabolic activity as a result of cutting, and this, according to Miss Hyman, causes chemi-

1 Morgan, T. H., 1905, "Polarity considered as a phenomenon of gradation of materials." *Jour. Expt. Zool.*, Vol. 2, p. 495.

2 Loeb, J., 1906, "The Dynamics of Living Matter." Columbia University Press.

3 Mathews, A. P., 1903, "Electrical polarity in the hydroids." *Am. Jour. Physiol.*, Vol. 8, p. 294.

4 Child, C. M., 1915, "Individuality in Organisms." University of Chicago Press.

5 Hyman, L. H., 1918, "Suggestions regarding the causes of bioelectric phenomena." SCIENCE, N. S., Vol. 48, p. 518.

cal changes which are directly responsible for the electropotential differences.

Child's experiments on planaria show that in a piece cut from that portion of the animal just posterior to the pharynx, the original polarity usually gains a new expression in regeneration, a new head appearing at the anterior end; the anterior end dominates the rest of the piece and the natural response of a dominant, undifferentiated region in a piece of planarian is the formation of a head. Polarity, however, may be altered, as is witnessed by all cases of heteromorphosis. Lund[6] has reported cases of partial reversal of polarity in *Bursaria* and has completely reversed the polarity of *Obelia commisuralis* by means of the electric current. This reversal was apparently due to direct action of the current on the electrochemical polarity of the organism, but if electrochemical polarity is the result of metabolic differences it should be possible to control the expression of polarity by any external influence which would properly affect metabolism. It is this sort of a regulation of polarity which I have studied, under the direction of Dr. J. Frank Daniel, and wish here to report.

Short, transverse pieces were cut just posterior to the pharynx, from normal, averaged sized individuals of *Planaria maculata,* collected in the Golden Gate Park in San Francisco, and allowed to regenerate. The percentage of cases in which the original polarity reappeared in regeneration was very large. Occasionally, however, there was developed a heteromorphic individual, with a head at either end. Such individuals developed only from extremely short pieces, and in all cases the head which appeared at the originally anterior end of the piece was slightly larger and better developed than the posterior head, which frequently showed some abnormality of the eyes or other feature. In such a case, although there has been obviously some disturbance of the simple, axiate polarity of the normal worm, there is not a real reversal of the polarity of the individual as a whole, for the originally anterior region is still able to exert a certain degree of dominance over the whole individual. It is, however, a partial reversal, for the tail has become the head. It should therefore be possible to secure an individual of completely reversed polarity by separating this posterior portion, which has to a certain extent attained an individuality of its own, from the anterior, partially dominant individual. Complete reversal of polarity was actually accomplished in this way, for when the two heads were separated, each of the resulting pieces became an apparently normal worm, a tail developing at each cut surface. The posteriorly directed heads were in some cases watched for more than two weeks after isolation and always retained the reversed polarity, developing into worms apparently quite normal and with a pharynx normally placed, but which were, in the matter of polarity, the exact opposites of the individuals from which the pieces were originally obtained.

A piece isolated from the body of a planarian must of necessity undergo a considerable rearrangement in all its life processes; it is only because these processes are extremely simple and generalized that the piece can at all survive such isolation. Since the metabolic gradient extends the length of the organism any isolated piece will possess a part of the gradient, so that the anterior end of the piece will be undergoing metabolism more rapidly than is the posterior end. But the establishment of polar relations in the new individual is also partially dependent upon the stimulation of the act of section. The anterior cut surface has been set free from all more anterior levels and is thus stimulated to a greater extent than is the posterior cut surface, which is still under the dominance of the regions above it in the gradient. Given an ordinary, isolated piece, Child explains that head frequency or capacity to form a head at the anterior end of the piece may be expressed by the ratio rate x/rate y, where rate x is the metabolic rate of the cells at the anterior surface and rate y that of the piece as a whole. If rate x is high enough to dominate the piece as a whole, a head will form, but if rate y is high relative to rate x, an imperfect head or none at all will form. In a very short piece, such as those which give rise to the heteromorphic individuals, the initial gradient can not be very pronounced, and on the cells at the posterior cut surface, which may be called the z cells, the stimulation of section may consequently be almost as great as on the x cells, making the z region also independent of the piece as a whole. In that case, head frequency for a posteriorly directed head may be expressed by the ratio rate z/rate y. The heteromorphic individuals may be considered as possessing two oppositely directed gradients which meet at their lowest points, and when these gradients are separated, each piece should regenerate with relation to its own gradient, uninfluenced by the gradient of the other; such indeed was seen to be the case. The two worms thus produced from a single piece taken from the "parent" worm appear to be identical in form, activity, etc., but when their origin is considered, it will be recognized that one is the direct opposite of the other.

The reestablishment of polarity thus seems to depend on a balance between the very strong factor of a previously established polarity and various external influences, which are able materially to affect this

[6] Lund, E. J., 1917, "Reversibility of morphogenetic processes in Bursaria." *Jour. Expt. Zool.,* Vol. 24, p. 1. 1921. "Experimental control of polarity by the electric current." *Jour. Expt. Zool.,* Vol. 33.

polarity only when that factor is weakened by some such condition as unusual shortness of the piece.

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THE EFFECT OF DRYING UPON THE ACIDITY OF SOIL SAMPLES[1]

BURGESS[2] has recently reported a study of the effect of air and oven drying upon the H-ion concentration of soils, using samples of Miami silt loam from a series of plots at the Rhode Island Agricultural Experiment Station. He found that drying had little or no effect upon acid soils, but increased the H-ion concentration of alkaline soils.

In an investigation of the H-ion concentration of Minnesota soils that has been in progress for some time at this laboratory, numerous samples of soil from different parts of the state and from soil types of different genesis have been tested. Early in the investigation we tried to determine the proper conditions of moistness and freshness of the samples and have now satisfied ourselves that the determinations should be made with soil freshly taken from the field from which little or no moisture has been allowed to escape. Only then are the results a reliable indication of the conditions actually existing in the field.

In order to determine the effect of drying upon the H-ion concentration, we made determinations upon about 200 samples of soils in both the moist and the air-dry condition. With part of these oven-dried samples also were used. All the determinations were made by the gas chain electrometric method.

Comparing samples from five of our experimental fields, the soils of which are naturally acid, we find that samples from one field show marked changes upon being allowed to become air dry; those from two fields change somewhat less, but still appreciably, and those from the remaining two change only slightly. Generally the H-ion concentration increased, but in a few instances it decreased. With the samples from plots where sufficient lime or marl had been added to make the soil alkaline, some showed no change in H-ion concentration, some an increase and others a decrease upon air-drying.

A group of 92 glacial soils, partly acid and partly alkaline, were found after air-drying to be decidedly more acid than before, the alkaline soils, however, showing the more marked change. A group of loessial soils, on the whole more acid than the glacial soils, showed less change.

Oven-drying was found to increase the H-ion concentration more than air-drying. Samples moistened after air-drying became more acid than the original moist samples and usually more acid than the air-dried samples. Moist samples kept in air-tight glass containers generally become more acid on standing; out of 20 samples tested, 13 became more acid, five showed little change and two became less acid.

H-ION CONCENTRATIONS OF FRESH AND DRIED SOILS SHOWING VARIABLE EFFECT OF DRYING AND REMOISTENING

Sample No.	Formation	Fresh pH	Air-Dried pH	Oven-Dried pH	Remoistened pH
1	Glacial Outwash	5.53	5.79		
2	" "	6.32	5.33	5.21	
3	" "	7.20	6.54	6.04	
4	" "	7.34	7.66		
5	Till Plain	5.44	5.19		5.28
6	"	5.60	5.46		5.04
7	"	5.78	5.74		
8	"	6.20	5.90	5.55	5.50
9	"	6.49	5.11		
10	"	7.19	6.54		6.15
11	"	8.00	7.39	7.79	
12	Loessial	5.87	5.80	5.31	
13	"	6.32	5.90	5.19	5.02
14	"	6.63	6.12	5.34	
15	"	7.51	7.13		

Air-dried samples, when tested by the qualitative potassium thiocyanate method, gave a more acid reaction than moist ones freshly taken from the field. The full data are now being prepared for publication, but the accompanying few given in the table will serve to illustrate the magnitude of the changes we have found.

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[1] Published with the approval of the director as Paper No. 373 of the Journal Series of the Minnesota Agricultural Experiment Station.

[2] SCIENCE, 1922, N. S., 55, 647–648.

THE BENEFICIAL EFFECT TO WHEAT GROWTH DUE TO DEPLETION OF AVAILABLE PHOSPHORUS IN THE CULTURE MEDIA

THE exceptionally good growth wheat seedlings, grown four weeks in complete nutrient solutions, make when transferred to aqueous culture media that contain all essential nutritive salt elements except phosphorus, presents a problem of great importance from the standpoint both of theory relating to fertilizer practice and of that pertaining to the physiology of the wheat plant. In experiments designed to test the effects of the absence of the commonly assumed essential elements in the culture media at various stages of growth on the development of wheat, it

was found that eight weeks after the transfer above referred to was made, the cultures grown in media devoid of phosphorus far excelled those grown in complete nutrient solutions that were not allowed to be markedly depleted of any essential salt elements. The former set of cultures exceeded the latter in height, weight of plants and earliness of heading. Comparison as to height was 50 inches and 36 inches and that of the weight of green plants 700 grams and 480 grams. Wheat grown an equal length of time from the early seedling stage in nutrient solutions devoid of phosphorus made very little growth, the weight being approximately 30 grams. It appears, therefore, that while phosphorus is needed in the early growth period of wheat, it is not only useless, but relatively harmful, if present in appreciable quantities in physiologically available form in the culture media for the latter growth periods.

These results call for a marked revision of the theory underlying the use of phosphates as fertilizers. The fact that the absence of phosphorus in aqueous culture media during approximately three fourths of the entire growth period of wheat, which included the fruiting stage, is decidedly beneficial not only suggests but is inferential evidence that analogous conditions may prevail in soils, and that large yield of wheat (and presumably that of other crops) results from and is conditioned by the depletion of physiologically available phosphorus in the soil during certain periods of growth of the plants. If the thesis in ecological principle and plant adaptation is true, as it appears it must be, that whatever growth a plant makes under any given set of conditions is the best growth for that particular set of conditions, then the beneficial effect to plant growth of the absence of phosphorus in the nutrient solution, as compared with one that contains this element for the particular phase of growth to which it applies, is the expression of an ecological factor concerned in crop production, to which wheat has become adapted to produce maximum yield.

But is phosphorus in fertile soils generally physiologically unavailable to wheat plants during the later phases of their growth? Answer to this question involves consideration of several points. In the first place, while it is generally assumed that if phosphorus in the soil is in water-soluble form, it is therefore physiologically available, nevertheless results of physiological experimentation have neither satisfactorily proved nor disproved this assumption. As physiological availability of an element is determined by the measure of growth it has produced and not by the amount of that material absorbed by the plant, it follows that neither chemical analysis of plant nor of water extract of that soil can give the answer. However, as analyses of soil extracts show that the concentration of water soluble phosphorus is usually very low during the greater part of the growing period of cereal plants, it appears, therefore, that the mechanics in the soil that meet these particular physiological requirements of the plants to render phosphorus unavailable for the later growth phase of wheat, lies in the low rate of solution of this material.[1]

As already mentioned in a previous paper,[2] results obtained from this type of experimentation led the writer to define the crop-producing power of soils as a function of the rate of the temporary depletion of certain nutrients in physiologically available form. Because plant growth is improved by the seasonal depletion of certain nutritive elements in the growth media, therefore yield of crop can not be expressed as a function of the supply of available nutritive material either in aqueous culture media or in the soil. The supply of nutritive material is only one factor of the more comprehensive expression herein stated that defines crop-production as the correlated response of progressive and changing conditions in the soil.

The fact that for certain periods of growth of the plants the absence in the culture media of material extensively used as a fertilizer is decidedly beneficial to plants must necessarily call for a thorough study of the economy and use of fertilizers in general. In no way have the results of the experiments herein quoted invalidated the soundness and economy of the use of phosphates on land when needed. However, due to the fact that in innumerable experiments, no increase in production obtained where phosphates or other fertilizers were applied, it is quite obvious that some heretofore unaccounted for factor had been operative to negative anticipated or hoped for results. But in the light of this investigation, which shows certain nutritive elements may be required at certain phases of growth of plants and not at others, or are beneficial at certain phases of plant development and relatively harmful at others, it follows that a rational basis of fertilizer application can be founded only on the knowledge of nutritive requirements of plants at various phases of growth and on that of the progressive changes that take place in the supply of physiologically available nutritive material in the soil.

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[1] Burd, J. S., and Martin, J. C. "Secular and seasonal changes in the soil solution" (in preparation).

[2] "The beneficial effect to plant growth of the temporary depletion of some of the essential elements in the soil," W. F. Gericke, Science, April 4, 1924, Vol. LIX: 1527.